ENGINEERING INSURANCE - THE ENABLER OF INNOVATIVE SOLUTIONS FOR THE MANAGEMENT OF CLIMATE CHANGE

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Head of Geo Risks Research/Corporate Climate Centre

43rd IMIA Meeting, September 13, 2010, Berlin

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Munich Re´s Approach to Climate Change

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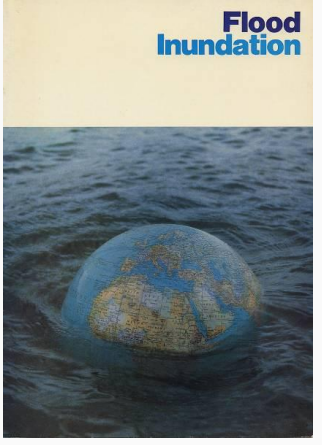
- Leading role in covering risks of natural hazards
- Already in the early 1970s perception of Munich Re Board that extreme weather patterns are changing
- In 1974 Geo Risks Research founded
- Munich Re the First Alerter in the Industry to Global Warming
- In 2007 Munich Re defines Climate Change as Strategic Topic
- Currently strategies to support both climate protection and adaptation to the unavoidable changes



Munich Re Publication 1973

Top 5 Risks for the Insurance Industry
Interviewed more than 70 industry analysts from around the world

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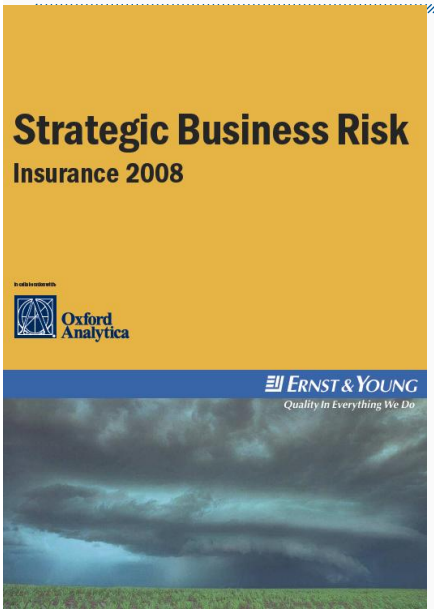

1. **Climate Change**
   Long-term, far-reaching and with significant impact on the industry.
2. **Demographic Shifts in Core Markets**
   Offers business opportunities but risk that other sectors will capitalize first.
3. **Catastrophic Events**
   Rising costs and serious impact on earnings for insurers.
4. **Emerging Markets**
   Risk and opportunity but competitive threat from new players.
5. **Regulatory Intervention**
   Increased scrutiny impacting on operations and practices.

Changing Hazards of Weather Related Natural Catastrophes

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- More intense weather events
- More frequent weather extremes
- Loss potentials have reached new dimensions

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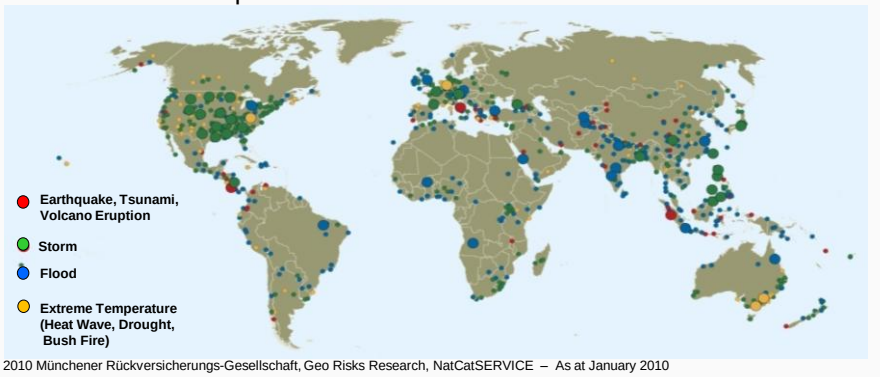
The world's most comprehensive database on natural catastrophes

- From 1980 until today all loss events
- For USA and selected countries in Europe all loss events since 1970
- Retrospectively all Great Natural Catastrophes since 1950
- In addition all major historical events starting from 79 AD (eruption of Vesuvio)
- **Currently more than 28,000 events documented**

850 natural catastrophes in 2009



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Global weather catastrophes 1980 – 2009

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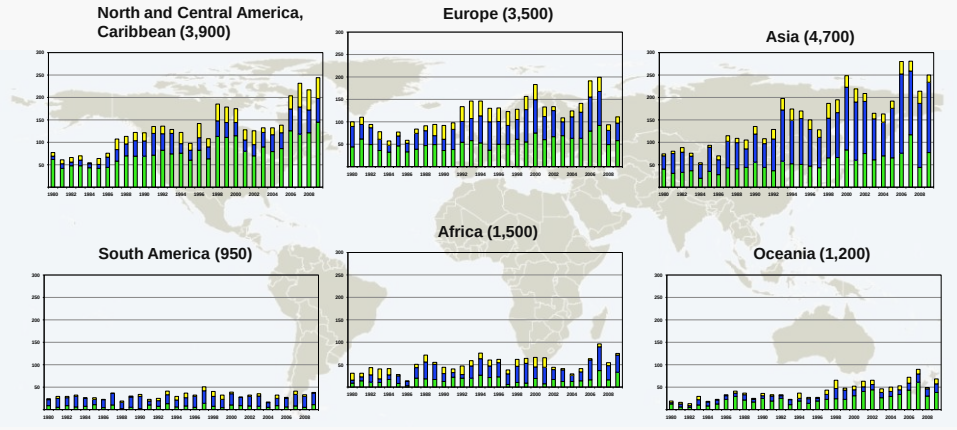
Number of weather related events per continent



Meteorological events (Storm)

Hydrological events (Flood, mass movement)

Climatological events (Extreme temperature, drought, forest fire)

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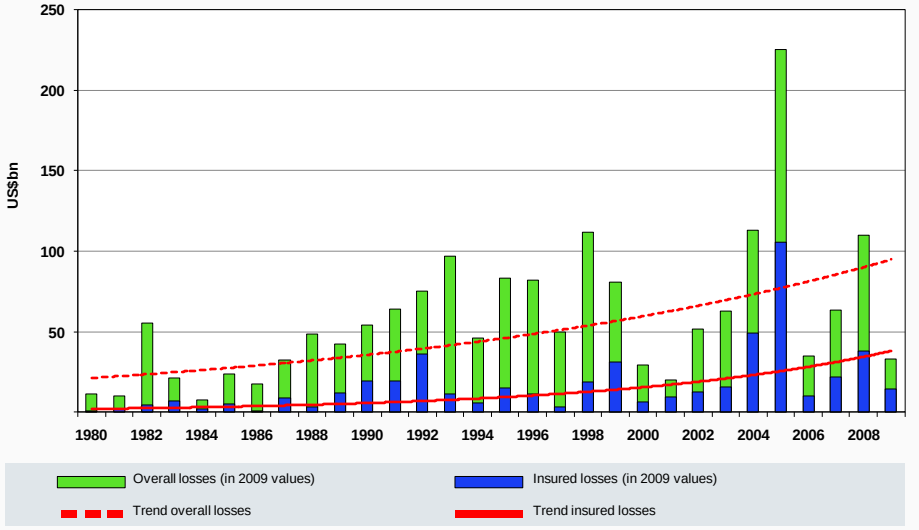
Natural catastrophes 1980 – 2009 (global)

Overall and insured losses of devastating weather catastrophes with trend (catastrophe class 5-6)



Reasons for globally increasing losses caused by natural disasters

- **Rise in population**
- **Better standard of living**
- **Increasing insurance density**

In general no problem for insurance as premiums rise proportionally with risk!

- **Settlement in extremely exposed regions**
- **Increased vulnerability of modern societies and technologies to natural hazards**
- **Change in environmental conditions - Climate Change**

Problem for insurance, if risk models are not adapted to the changes!

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Global natural catastrophes 1980 – 2009

Trend of events (catastrophe class 1-6)

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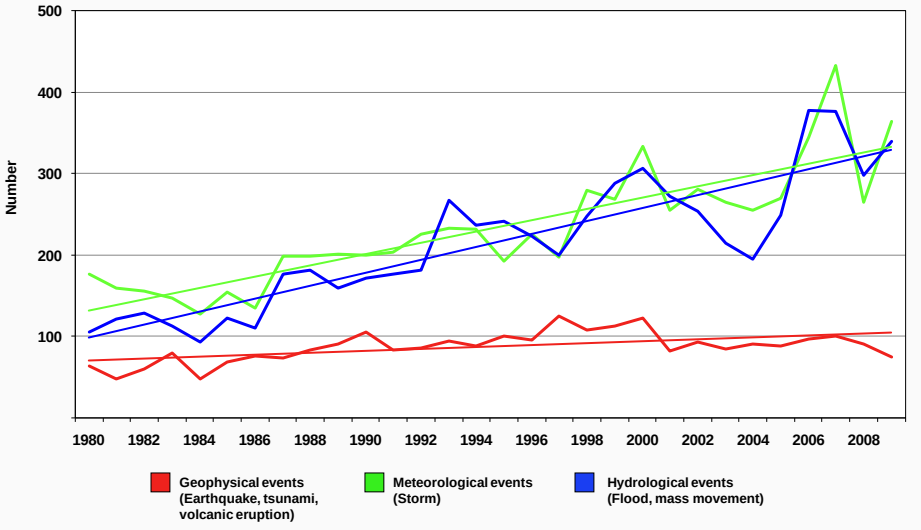

Climate Change and Extreme Weather Events (IPCC, 2007)

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Phenomenon[a] and direction of trend	Likelihood that trend occurred in late 20th century (typically post 1960)	Likelihood of a human contribution to observed trend[b]	Likelihood of future trends based on projections for 21st century using SRES scenarios
Warmer and fewer cold days and nights over most land areas	*Very likely*[c]	*Likely*[d]	*Virtually certain*[d]
Warmer and more frequent hot days and nights over most land areas	*Very likely*[e]	*Likely (nights)*[d]	*Virtually certain*[d]
Warm spells/heat waves. Frequency increases over most land areas	*Likely*	*More likely than not*[f]	*Very likely*
Heavy precipitation events. Frequency (or proportion of total rainfall from heavy falls) increases over most areas	*Likely*	*More likely than not*[f]	*Very likely*
Area affected by droughts increases	*Likely* in many regions since 1970s	*More likely than not*	*Likely*
Intense tropical cyclone activity increases	*Likely* in some regions since 1970	*More likely than not*[f]	*Likely*
Increased incidence of extreme high sea level (excludes tsunamis)[g]	*Likely*	*More likely than not*[f,h]	*Likely*[i]

very likely > 90% **likely >66%** **more likely than not > 50%**

Global Warming is Real!
Continental Temperature Changes

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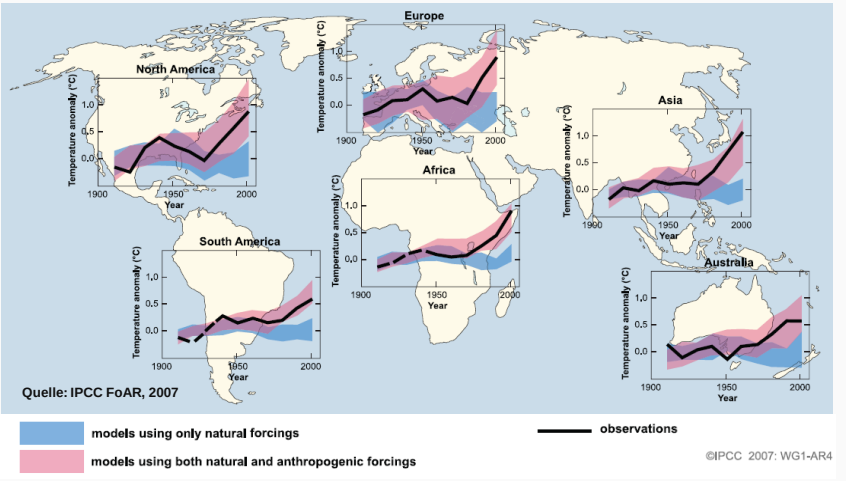

Black lines: decadal averages of observations
Blue band: 5-95% range 19 simulations from 5 climate models using only natural forcings
Red band: 5-95% range for 58 simulations from 14 climate models using natural and anthropogenic forcings

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CO_2 concentration in the atmosphere

of the past 650,000 years from Antarctic ice core data

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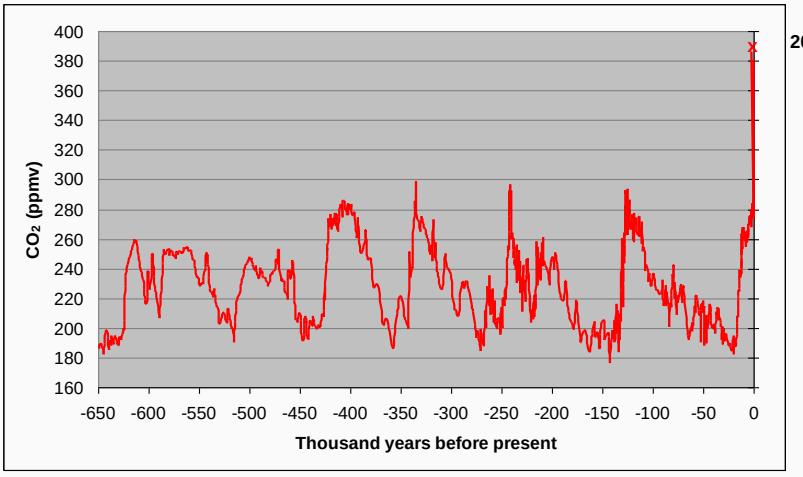

2010: 390 ppm

Sources: Siegenthaler et al., Science (2005). Etheridge et al., J. Geophys. Res. (1996). Petit et al., Nature (1999). Fischer et al., Science (1999). Indermühle et al., Geophys. Res. Lett. (2000). Monnin et al., Earth Planet. Sci. Lett. (2004). Monnin et al., Science (2001).

Observed changes in sea surface temperature in tropical ocean basins with TC activity

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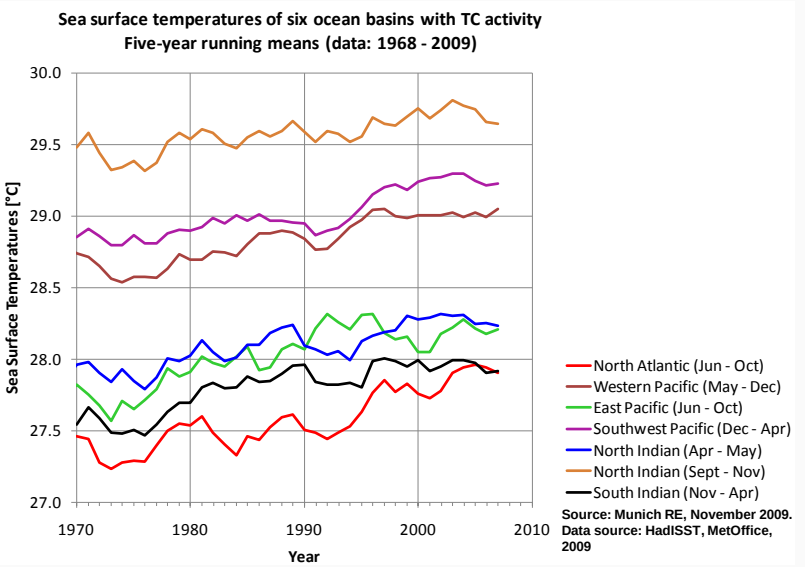

2010: Global Warming Sets New Records
First seven months in 2010 warmest since 1880!

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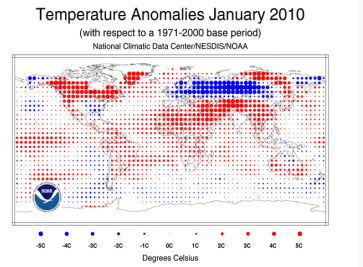
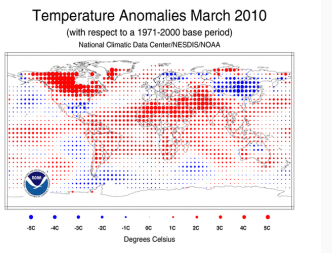
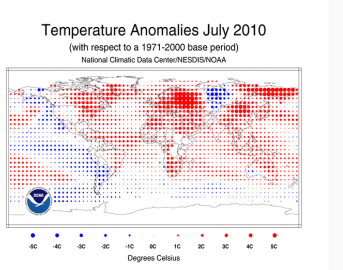




January 2010: 4th warmest
February 2010: 6th warmest
March 2010: 1st warmest
April 2010: 1st warmest
May 2010: 1st warmest
June 2010: 1st warmest
July 2010: 2nd warmest



2010: Global Warming Sets New Records

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- New temperature record for Moscow on 29 July with 37.8°C, in other places in Russia more than 40°C.
- Highest ever measured air temperature in Asia: May 2010, Pakistan, 53.5°C
- Pakistan Flood in July and August 2010 the worst ever documented
- 1st half year 2010 with second highest number of weather related natural catastrophes since 1980
- Arctic sea ice cover at record low until end of June 2010
- August 2010 the wettest ever recorded in Germany

CO_2 – the Most Important Greenhouse Gas

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- CO_2 contributes more than 60% to anthropogenic global warming
- CO_2 on average stays in the atmosphere more than 100 years
- The largest part of CO_2 emissions stems from burning of fossil fuels

=> Key to long term environmentally friendly and sustainable energy supply are renewable energies

Potential for Renewable Energies

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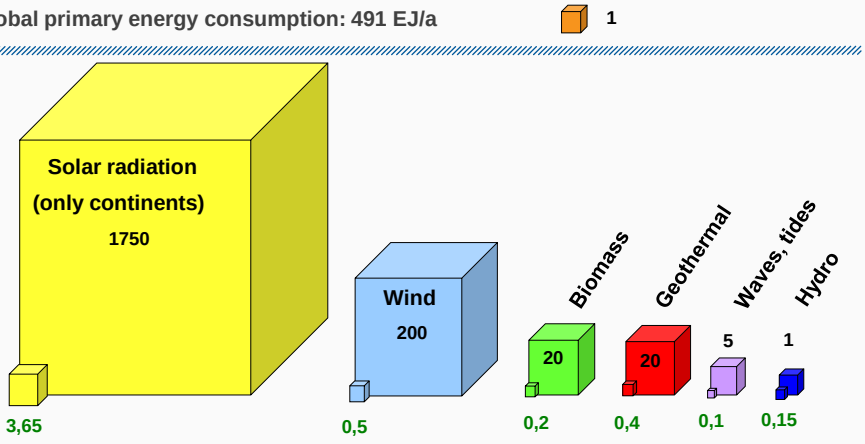
Global primary energy consumption: 491 EJ/a



Physical energy potential:	**ca. 2 000**
Technical potential (existing technologies):	**ca. 5**

Source: Dr. Joachim Nitsch, DLR, Stuttgart

A Big Step to a Solution: Munich Re has initiated the foundation of the Desertec Industrial Initiative (Dii GmbH)

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Origin and Vision

- Developed by the Club of Rome's TREC Initiative
- **Vision**: Providing EUMENA with sustainable renewable energy from the desert in North Africa

Figure: Desertec Foundation

Within 6 hours, deserts receive more energy from the sun than humankind consumes within a year.

Regions with high potential for solar electricity generation

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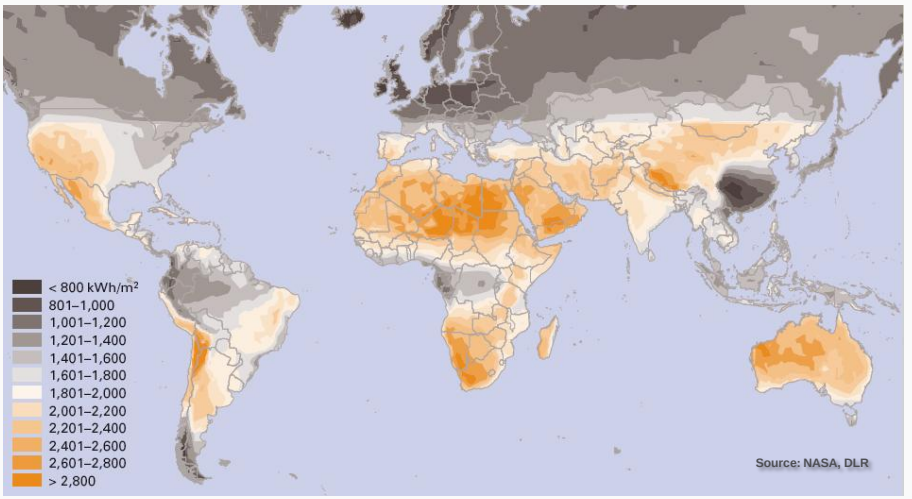
Global distribution of direct normal radiation (needed for CSP* technology)



*Concentrated Solar Power

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Motivations for the Dii GmbH

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Basic assumptions and facts

- Sources of renewable energy are abundant.
- The concept aims to make use in particular of solar energy from the deserts, the biggest energy resource available on earth and also other renewable energy sources.
- 90% of the world's population are living less than 3.000 km from deserts and thus could be easily supplied via efficient modern HVDC lines with clean power.
- The concept offers an integrated solution for a variety of mankind's key future problems: Climate change, lack of energy, lack of drinking water, further economic development for MENA*.

*Middle East and North Africa

Source: www.desertec.org

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The founding of the Dii GmbH

Milestones

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07/13/09

- Joint signature for a memorandum of understanding by 12 companies and the DESERTEC Foundation for the formation of the Dii GmbH

10/30/09

- Legal foundation of the planning company
- Appointment of Paul van Son as CEO
- Definition of Dii's governance structure

Dii – Renewable energy bridging continents

03/10/10

- Appointment of Prof. Klaus Töpfer as special envoy

10/31/12

- Development of an implementable roadmap to „green energy generation" in the deserts of North Africa and the Middle East

2020

- 20GW installed capacity (according to political goal of MSP)

2050

- 100GW installed capacity (referring to the 15% aim of the Dii concept)

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Dii GmbH – Current Shareholders and Associated Partners

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Dii Shareholder (as at June 2010)

Dii Associated Partners (as at July 2010)

Dii GmbH objectives

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Overview of the main modules

Regulatory / legislative environment	▪ Analyse and develop a technical, economic, political and regulatory framework for feasible investments into renewable energy and interconnected grids
Roll-out Plan / financing	▪ Develop a detailed roll-out plan until 2020 ▪ Develop a long-term roll-out plan for the period up to 2050, providing investment and financing guidance
Additional studies	▪ Originate some early reference projects to prove the feasibility of the concept ▪ Conduct in-depth studies on specific subjects

Result from pre-studies by the German Centre for Aerospace

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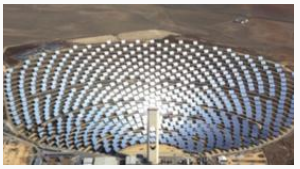
Generation: Advantages for CSP plants



Concentrating Solar-Thermal-Power-Plants (CSP):

- Focusing of solar power with the aid of mirrors
- Transformation of radiation into heat
- Power generation by steam turbines
- Turbines can supplementary be run by biomass or gas
- A 250 MW collector field may be used to operate a 200 MW turbine

- ➔ **Base load capability**

Reflects current status, however Dii remains open to new technologies!

Result from pre-studies by the German Centre for Aerospace

Transmission: Advantages for and high-voltage direct current grids

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Source: Böhm, Siemens AG

High-voltage direct current (HVDC)

- Losses add up to a maximum of 3% every 1,000 km of transmission
- Existing experience with HVDC grids up to 3 – 5 GW capacity (Siemens, ABB)
- The DLR has estimated that the costs of producing and transporting solar-thermal power between 2020-2030 will be lower than that of the conventional power production technologies in Europe due to constantly rising fuel prices and environmental costs

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Long-distance electricity transmission

HVDC transmission lines in China and Europe

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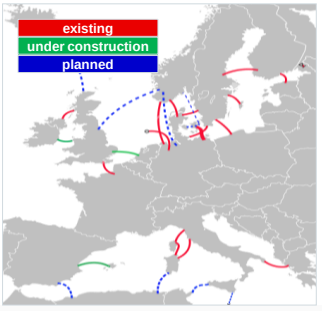

- Technology available: overhead transmission lines, submarine cables, underground cables
- China: Xiangjiaba–Shanghai, one of the world's longest transmission links with a capacity of 6,400 MW over a distance of 2,000 km (under construction)
- Europe: longest submarine cable and longest transmission link from Norway to the Netherlands (580 km, 700 MW)

Source: ABB, Siemens

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Munich Re's goals as the initiator of the Dii GmbH

www.dii-eumena.com

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Long term	CLIMATE PROTECTION	Support of CO_2 mitigation projects
	BUSINESS OPPORTUNITIES	Leading provider of renewable energy insurance
Mid term	INSURANCE SOLUTIONS FOR RENEWABLE ENERGIES	Leading role in developing new risk transfer solutions for renewable energies / new technologies
	INVESTMENT	New (direct) investment options

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Munich Re Publication on „Energy Situation, Problems with Commodities and Insurance" dated 1978

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Das Titelbild zeigt eine Sonnen- oder Solarfarm, wie sie für Afrika und die südlichen Gegenden Europas konzipiert wird. Mehrere zusammengeschaltete Parabolspiegel sorgen für Wassererhitzung im Paraboloidbrennpunkt. Der Wasserdampf wird zu einer Dampfturbine geleitet, die einen Stromgenerator antreibt. Vor dem Rücklauf zu den Spiegeln durchläuft das Wasser noch einen Kühlturm (neben dem Generator-Container sichtbar). Die hier gezeigte Anlage, deren kleinste Einheit auf 50 kW ausgelegt ist, wurde vom Luft- und Raumfahrtkonzern Messerschmitt-Bölkow-Blohm entwickelt.

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Königinstraße 107, D-8000 München 40,
Bundesrepublik Deutschland.

Druck: Carl Gerber Grafische Betriebe GmbH,
Muthmannstraße 4, D-8000 München 45

Climate-change-related products: Mitigation

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Pre-event: mitigation of CO_2 emissions

- Insurance for renewable energies along the entire life cycle: delays or damage during the fabrication, transport, construction and operational stages of a RE project (technical failures, Nat Cat), loss of income due to business interruption, delivery guarantee, warranty, liability, financing.
- Carbon credit insurance: Coverage for risks related to carbon-credit generation and transactions.
- Car insurance: Incentives to decrease mileage, buy efficient cars (pay-as-you-drive insurance, premium discounts for low emission cars), carbon offset covers.
- Green building/rebuilding/equipment insurance: Premium discounts for renovated buildings, special green-building coverage, “green upgrade” coverage for buildings & equipment (e.g. HSB include coverage for 125% of the loss in order to replace damaged with more energy-efficient equipment.
- Energy efficiency: Insurance protects the owner of an energy-efficiency project against its failure to achieve predicted energy savings.
- Investments: Retail funds (e.g. Climate Strategy fund of MEAG)

Climate-change-related products: Adaptation

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Post-event: Adaptation

- Nat Cat insurance: higher demand for covers of losses caused by extreme weather events (e.g. flash floods)
- More public-private partnerships: e.g. Nat Cat cover for states such as CCRIF, MCII
- Increasing market for micro insurance products, risk covers for microfinance
- Weather products: Derivatives, equity-market products (ART), weather contingency, enterprise risks
- Engineering insurance for protective structures: Construction and operational e.g. dikes, causeways
- Engineering insurance for other adaptation options: e.g. desalination plants, irrigation systems

The General Roles of Insurance in the Climate Debate

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- **The first Alerter - Creating Awareness (nat cat databases, risk transparency)**
- **Providing Solutions for Mitigation**
- **Providing Solutions for Adaptation**
- **Investor into Climate Change Mitigation Processes**
- **Leader in Carbon Neutral Business Operation**

Development of Investments into Renewable Energies and Related New Technologies

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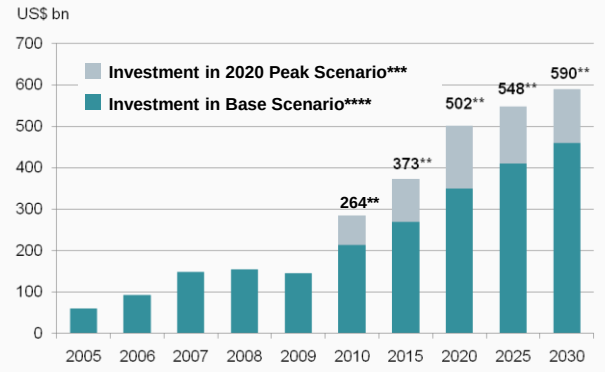
Global, 2005–2030*



* New investment in energy supplies including reinvestment, research and development costs and small-scale projects

** Forecasts

*** 2020 Peak Scenario: annual CO2 emissions have to peak before 2020 (to limit global mean temperature increase to 2 degrees)

**** Base Scenario ("business as usual")

Source: New Energy Finance 2010

Characteristics of Renewable Energies

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- High circadian, diurnal, seasonal and interannual fluctuations
- New technologies with little operational experience
- Construction in adverse environments (off shore, deserts)
- High initial investments necessary

-> Engineering insurance products will play a key role for the quick switch to renewables and thus for climate change mitigation and a long term sustainable energy supply.
Without appropriate insurance investors would shun to go into these new technologies.

Conclusions

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- Climate change is real and one of the largest risks humankind has to cope with in this century
- In order to avoid unmanageable conditions we have to reduce CO_2-emissions significantly
- Key to climate protection are renewable energies and increased energy efficiency
- New technological solutions can be supported by insurance covers, which transfer the largest risks for investors and thus incentivize investments
- Engineering insurance will play an increasing role in this
- Munich Re is ready to support new energy technologies by custom made insurance solutions

THANK YOU VERY MUCH FOR YOUR INTEREST

Prof. Dr. Peter Hoeppe, Munich Re

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